



# SCALES, RULES, POLICY, STANDARDS AND SCIENCE

This exercise examines the role of opinions, values, attitudes, beliefs, and science on the development of standards. Students will answer a series of abstract questions designed to demonstrate how a standard is developed. Students also will answer questions related to ecological standards. From the results of the survey, classroom-wide standards will be developed to reflect the “consensus” of the class. This exercise is related to the “Writing Environmental Laws” and “Translating Science into Public Policy” activities.

## CRITICAL OBJECTIVES

- ☀ Identify methods to obtain information for developing standards
- ☀ Recognize conflicts that may exist between what people want and what can be achieved
- ☀ Translate objective and subjective data into standards

## SKILLS

- ☀ Collecting, tabulating, and analyzing data
- ☀ Drawing conclusions

## GUEST PRESENTERS

Guest presenters could include environmental scientists, EPA environmental protection specialists, or EPA risk assessment specialists.

## BACKGROUND

Governments rely on the development of standards as the basis of most regulations. For example, most environmental regulations are based on public or environmental health standards that help gauge the dangers posed by a certain level of pollution or contamination. However, people should understand that such standards are not purely scientific: “hard” scientific data is always subject to the political process before it is written into regulations. What’s more, there is often much disagreement within the scientific community over the data itself. Standards, then, are the result of these processes.

This exercise poses the question “How do we decide what a standard should be?” and focuses on the interplay of personal belief, opinion, and scientific facts and evidence in the development of standards and rules. Air quality policy and regulations are a result of the synthesis of scientific information and public attitudes and values. What costs



## RELATED ACTIVITIES

20, 21

## REFER TO READING MATERIALS

“The Clean Air Act”  
“Air Pollution”

## TARGET GRADE LEVEL

7th - 12th

## DURATION

30 minutes

## VOCABULARY

Scale  
Standards

## WORKSHEETS INCLUDED

1

people are willing to tolerate to maintain air quality is as critical to the development of air quality standards as the scientific health risks posed by air pollution.

In one sense, an air pollution standard reflects how much air quality the public is willing to buy. Often, there is a conflict between what people are willing to tolerate and what may be good for them. For example, smog is a major health concern in southern California, but people in Los Angeles have consistently resisted the imposition of restrictions on automobile driving even though auto exhaust is a major factor in smog production. Between the two extremes on this issue lies a position which, presumably, most people would be willing to adopt. This exercise demonstrates how such conclusions are reached. (See reading materials on "The Clean Air Act" and "Air Pollution.")



### WHAT TO DO

1. Discuss scales and methods by which things are measured: size, weight, volume, time, temperature. For example, time passes whether or not it is broken up into days. Discuss how it is reduced to discrete units (days, hours, weeks, years) in ways that all agree upon so that it may be used. In what ways are scales and measures useful? (Answer: so that one thing may be compared with another thing.)



2. Discuss standards and where they come from. For example, how would your class decide what the temperature of the room should be? Each person could be asked, and the result would be a range of temperature values. From there, the statistical mean temperature would represent a "fair" determination of the classroom-wide consensus. Mention Goldilocks and the Three Bears and the "just right" standard. How do we know what is "just right?" What effect does custom and convention have on an individual's belief?


3. Discuss the concept of rules and how standards are fashioned into rules. Ask students for examples of rules that govern their lives. What is the rationale for these rules? Distinguish the roles of objective facts and subjective beliefs. For example, young children may have a certain bedtime. Is this the result of extensive studies on the effects of sleep deprivation or because parents think it is a good idea? Discuss how sound rule-making requires information collection and the application of shared values.

4. Distribute the student worksheet. Ask each of the survey questions and have students mark their answers. Collect and tabulate the results. Discuss how to determine the classroom-

wide standards based on the results? Discuss the tradeoffs that are inherent in developing standards based on opinions and beliefs rather than strictly scientific conditions. (For example, how did they decide how much is “too much” pollution?)

5. Discuss the roles of scientific evidence and personal belief in answering these questions. Ask individual students what led them to answer a question in a certain way. Select students who answered the same question in opposite ways to “make their case.”

### **SUGGESTED MODIFICATIONS**

-  For grades 10 through 12, have students follow up this exercise by researching how generally accepted standards get translated into government policies, regulations, or laws. Have them make short presentations of their findings.

### **SUGGESTED READING**

“Green, Greener, Greenest.” *Economist*, 311 (6 May 1989) p. 67.

# STUDENT WORKSHEET 1

## **SCALES, RULES, POLICY, STANDARDS, AND SCIENCE SURVEY**

This questionnaire will be used to determine a classwide standard for a healthy environment. It also will ask questions about what individuals would be willing to do to achieve a healthy environment. Since it is Clean Air Month™, the questions focus on air pollution reduction and prevention.

### **AIR POLLUTION: HOW MUCH IS TOO MUCH?**

- 1) Air pollution is not a major problem in the United States.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 2) Air pollution is not a major problem in our town.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 3) Air pollution should be reduced to levels that do no harm to the environment or to people.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 4) Air pollution should be reduced to levels that do no harm to people and the environment regardless of cost.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 5) There is a safe level of air pollution (that is, some level of air pollution should be tolerated).  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 6) A safe level of air pollution should be achieved regardless of cost.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 7) The cost of air pollution reduction and prevention should determine the amount of pollution permitted.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 8) Activities that pollute the air should be prohibited.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree

### **AIR POLLUTION: WHERE DOES IT COME FROM?**

- 1) Human activity is the source of most air pollution.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 2) Visible air pollution is the most significant problem.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 3) Most air pollution is the kind that can be seen coming from smokestacks.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree

- 4) Most air pollution is emitted from automobiles.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 5) If it can not be smelled or seen, it does not matter.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree

### **AIR POLLUTION: WHAT IS THE SOLUTION?**

- 1) I am willing to change some of my everyday habits and ways of doing things that may cause air pollution (for example, conserve energy, use mass transit rather than drive, purchase environmentally friendly products).  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 2) I am willing to pay reasonably higher prices when necessary if it will help reduce air pollution.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 3) Future changes in technology will probably eliminate most causes of pollution by the time I am an adult.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree
- 4) I am willing to have the government tell me how to reduce pollution.  
1 - strongly agree   2 - agree   3 - neutral   4 - disagree   5 - strongly disagree

